

This Briefing is:  
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# ***Tactical Decision Aids for Mission Planning***



***“Providing warfighters with tools to  
exploit the battlefield environment”***

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AFRL/VSBL**



# ***Presentation Outline***

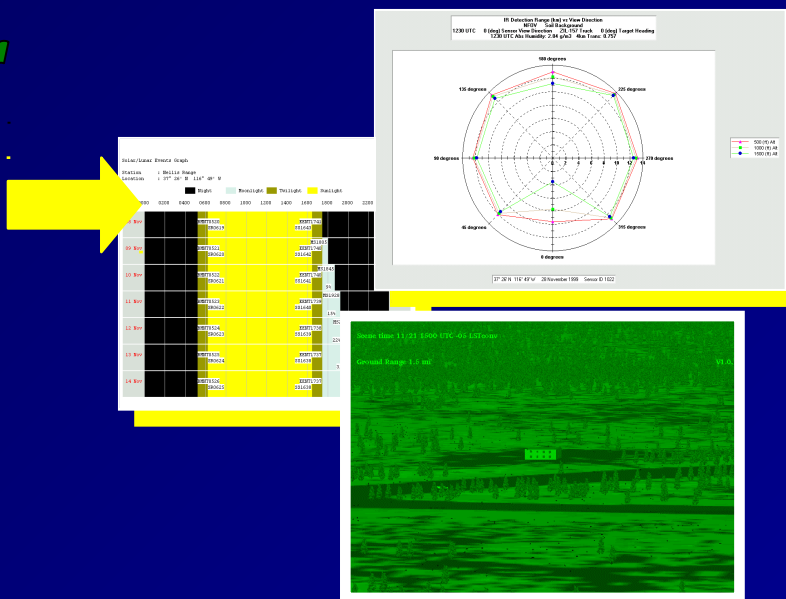
- **Introduction**
- **TAWS Overview**
  - **TAWS Architecture**
  - **Physical Models**
  - **Data Sources**
  - **Current / Future Work**
- **IRTSS Overview**
  - **IRTSS Architecture**
  - **Output Products**
  - **OIF Support**
  - **Current / Future Work**
- **WIDAs for Mission Planning**



# Operational Weather Support



Decision Aids predict how weather will impact EO sensor performance





# ***Why TAWS & IRTSS?***



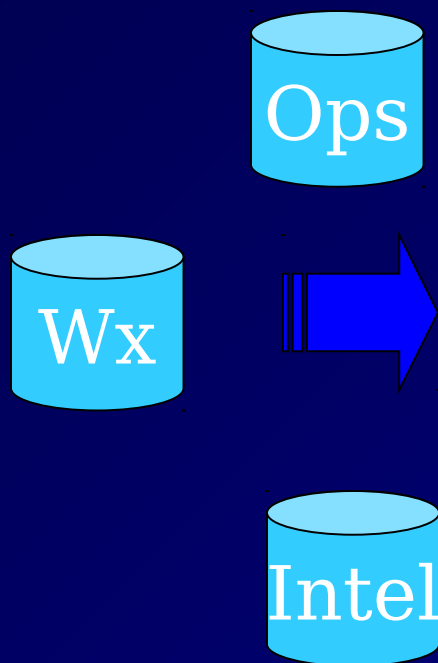
***“Optimize attack effectiveness-Minimize threat exposure”***

- Reduces critical heads-down time in the target area
- Improves target acquisition and detection
- Improved battlefield position selection



# Results

## Data



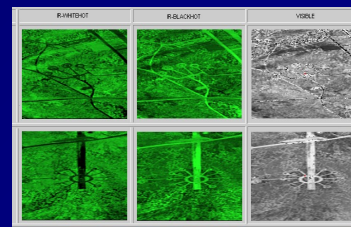
## Tools



## Decisions



**Mission  
Planning**



**Mission  
Rehearsal**



**Mission  
Execution**



# **Target Acquisition Weapons Software (TAWS) Overview**



# ***TAWS Objectives***



- **Support Air Force, Army, Navy, and Marines missions:**
  - surface attack - search and rescue
  - close air support - target detection
  - air interdiction - helicopter refueling
- **Predict weather effects on EO sensor performance:**
  - Daylight, Low Light Level TV - 8 - 12  $\mu\text{m}$  IR
  - NVG - 3 - 5  $\mu\text{m}$  IR
  - 1.06  $\mu\text{m}$  Laser
  -
- **Support standard computer hardware/software:**
  - PC-class systems - Multiple Windows OSs



# TAWS Input Screen



Point-based Target Acquisition

Target /  
Background...

Sortie...

Weather...

ZIL-157 Truck...

30° 25' 00" N 086° 41' 00" W

Soil

IR, NVG @ 5000 ft

TOT: 21 Oct 2002 1321 UTC

Wx Source: Defaults

Analyze...

Results

View Graph...

View Table...

< Back



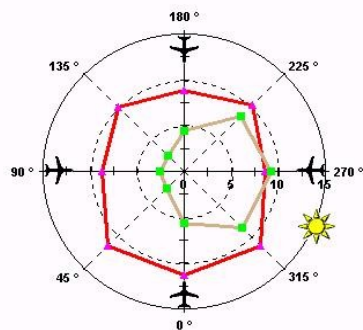
# TAWS Output Examples



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Slant Range (nm) vs Azimuth Angle (deg)

5000 ft Altitude Maximum Detection Range 50 % Probability Narrow Soil-Dry-Dry Background  
1321 UTC  
IR Vis 33.23 mi Abs Humidity 2.77 g/m<sup>3</sup> 4km Trans 0.824



— ZIL-157 Truck 270° Target Heading — BMP-2 Infantry Fighting Vehicle (APC) 180° Target Heading

30° 25' 00" N 086° 41' 00" W 21 Oct 2002 Sensor 1000  
Illumination (almanac) 26451770.0 mlux  
Illumination (weather) 26451770.0 mlux  
Solar Elevation 17°

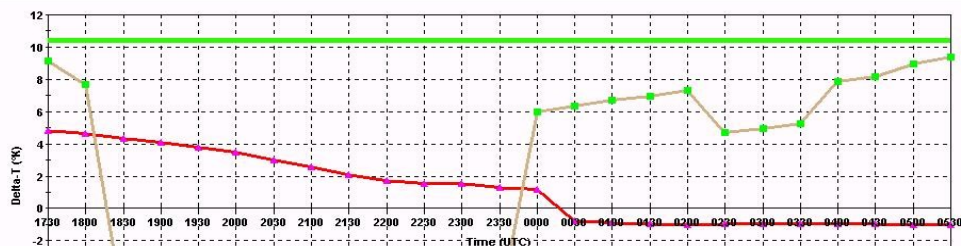
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## Tactical Tools

- Detection probability/ranges
- Best attack axis
- Attack timing
- Sensor cueing
- Thermal Crossover
- Polarity
- Illumination

## Calculates

- View direction dependence
- Time dependence



— ZIL-157 Truck 45° Target Heading — Default Power Plant 0° Target Heading — > 2.2 mlux (almanac)

37° 26' 00" N 116° 49' 00" W 21 Oct 2002 Sensor 1004

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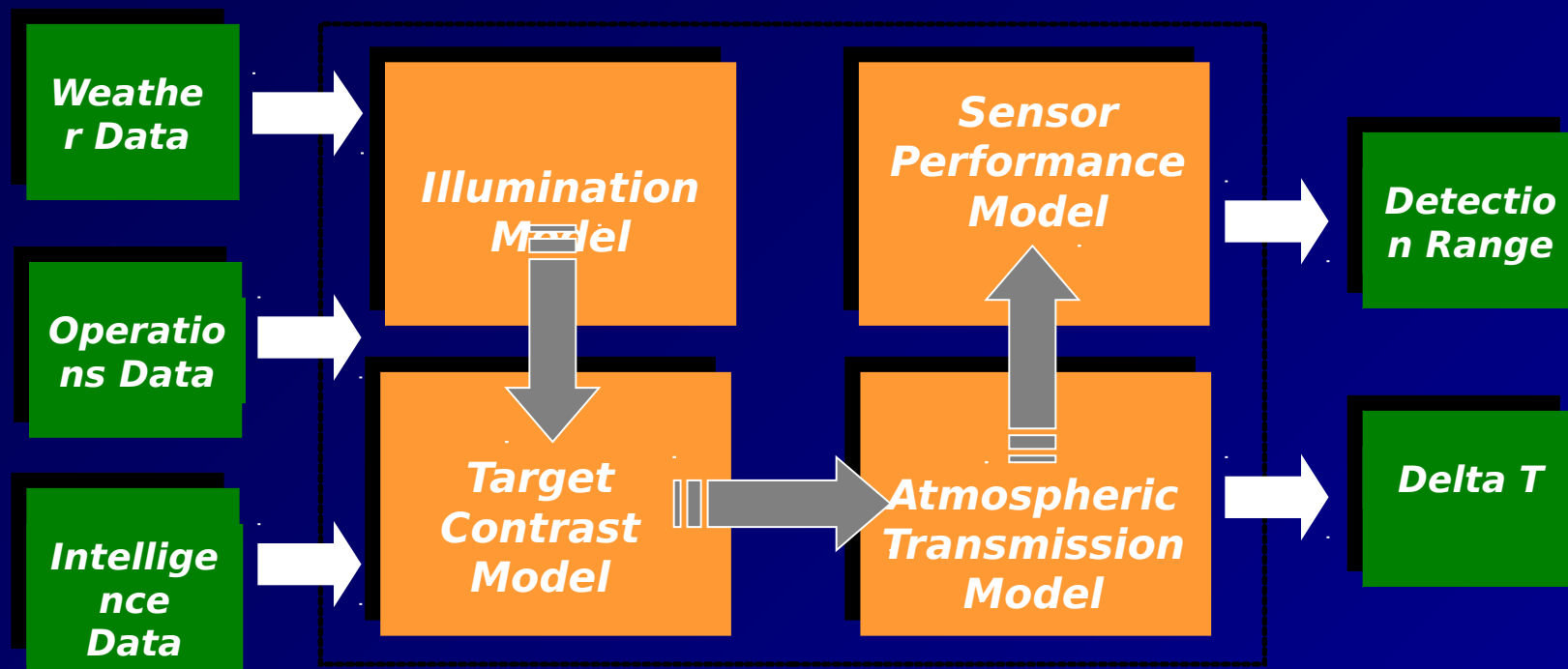
# ***Physical Model Wavelengths***

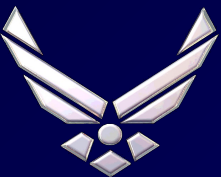


- **IR**
  - 8 - 12  $\mu\text{m}$
  - 3 - 5  $\mu\text{m}$
  - Detection, Lock-on Systems
- **TV**
  - 0.4 - 0.7  $\mu\text{m}$
  - Daylight, Low Light Level
  - Detection, Lock-on Systems
- **NVG**
  - 0.4 - 0.9  $\mu\text{m}$
- **Laser**
  - 1.06  $\mu\text{m}$
  - Designators, Receivers, Rangers

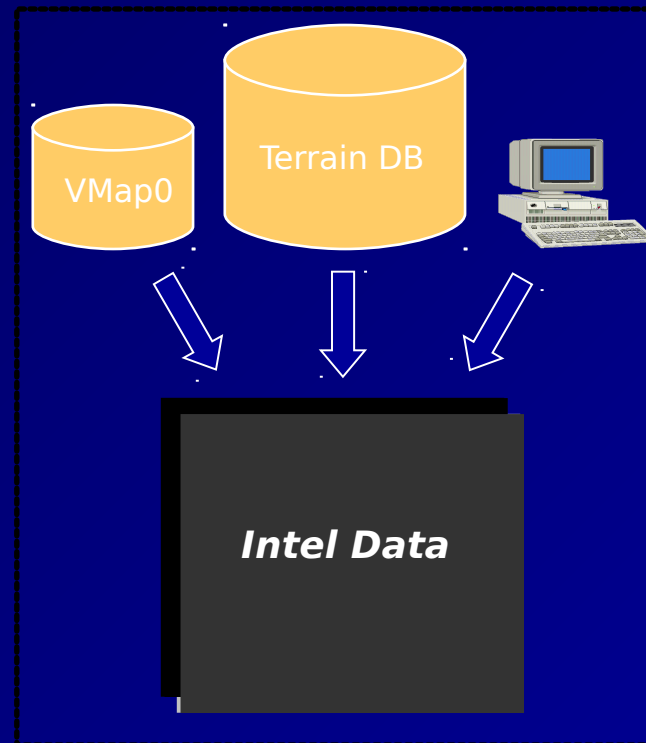
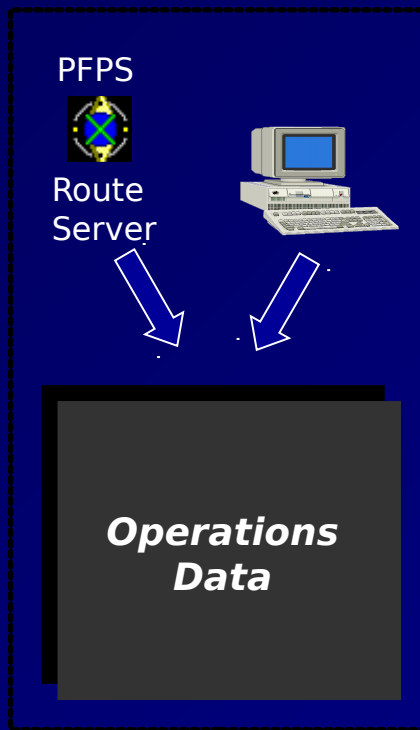
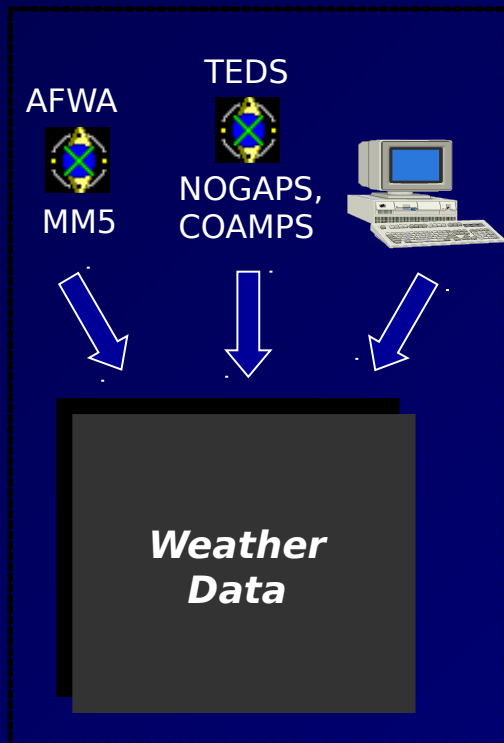


# Physical Model Components





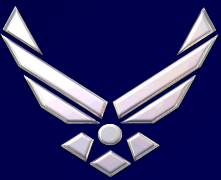
# Current Data Sources





# ***Current / Future Plans***

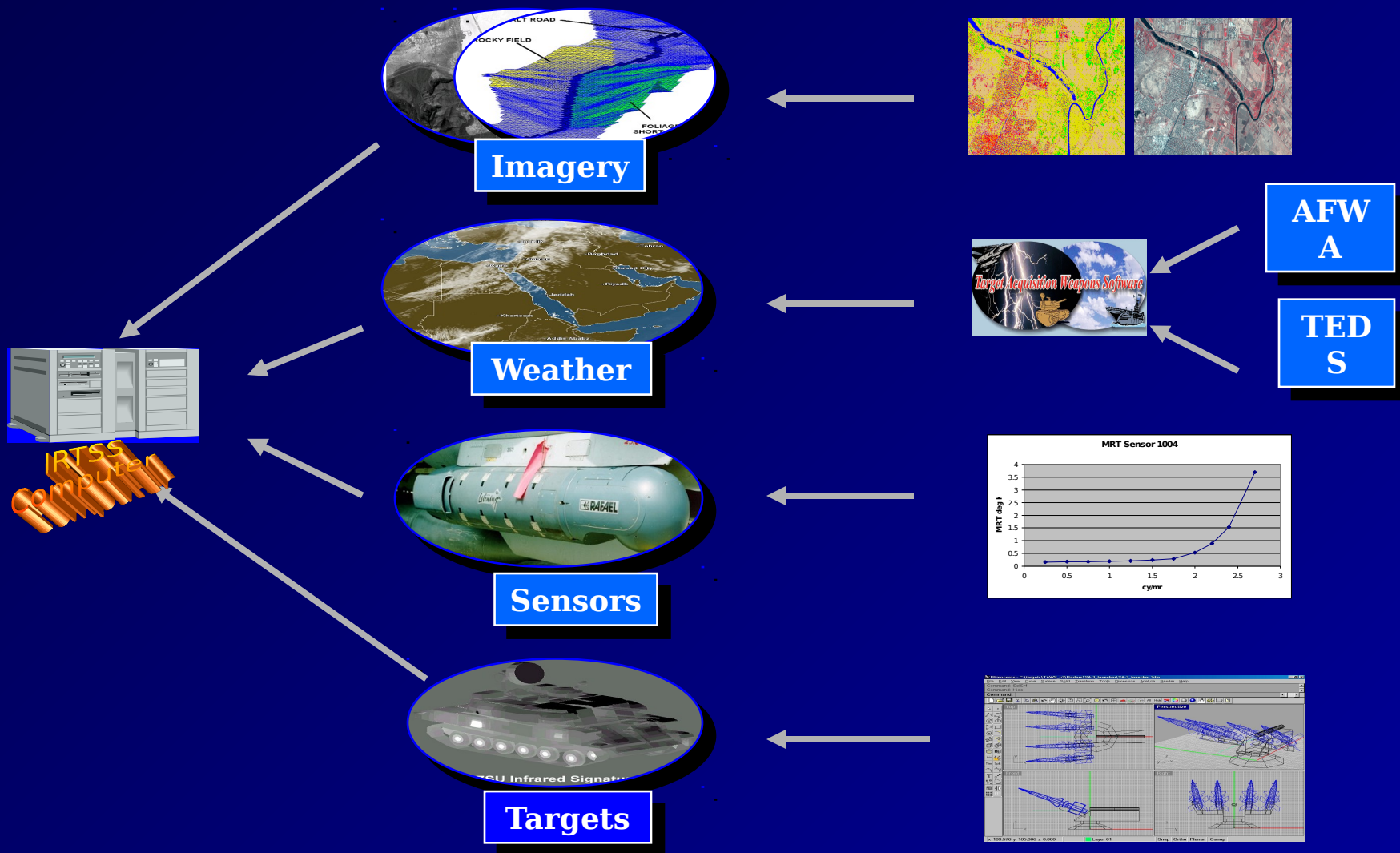
- **Targets / Backgrounds**
  - Support customized (editable) targets with appendable parts
  - Support environmental overlays
  - Add current and planned targets to the target database
- **Sensors**
  - Support Laser Marker (Near-IR Pointer)
  - Add current and planned sensors to the sensor database
- **Atmospheric Transmission**
  - Implement multi-layer transmission model
  - Support horizontal and upward LOS paths
  - Support smoke screens
- **Meteorological Data**
  - Access Army's GMDB
  - Include climatology database for default values



# **InfraRed Target Scene Simulation (IRTSS) Overview**

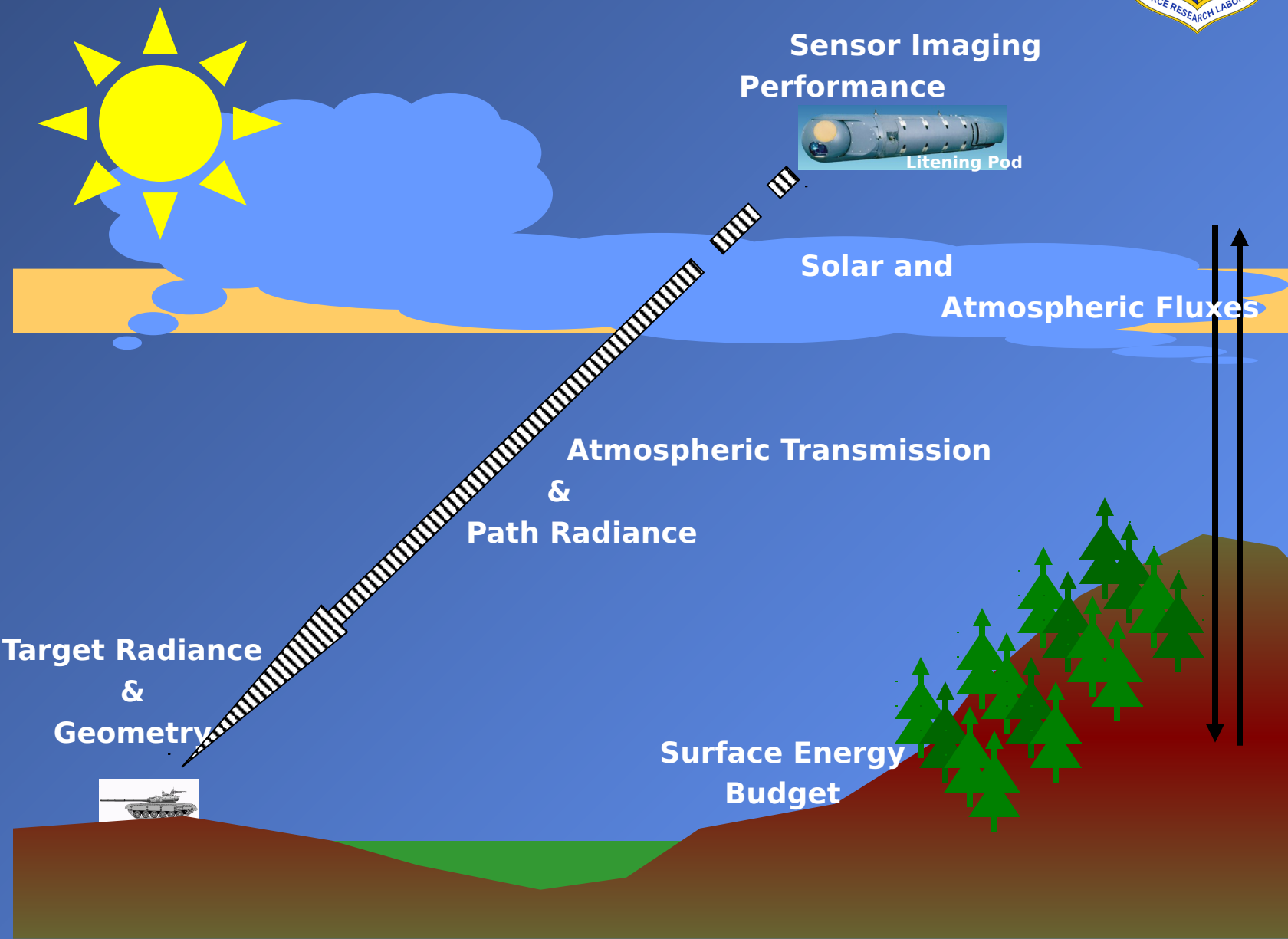


# IRTSS Components





# IR Modeling Overview





# ***IRTSS Objectives***



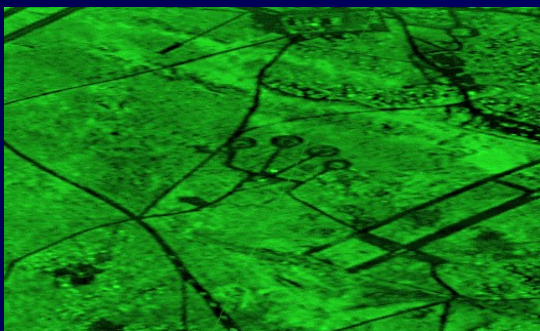
- **“Through-the-Sensor” target scene prediction in Thermal IR waveband**
- **Allows crew to view the target scene (AO) prior to step**

## **Requirements**

- **CFPS Route File or user defined Tactical/Intel inputs**
- **IRTSS Server - PC, Linux OS, NVIDIA, 2GHz**
- **TAWS Wx File**
- **<4m MSI/Pan imagery - Transition to ACC/IN 480<sup>th</sup>**
- **Tactical Information needed - Date/Time, lat/lon, sensor, FOV**
- **Intel Information needed - Target, Lat/Lon, Date/Time**



# ***IRTSS***



**IR Black  
Hot**



**IR White Hot**



**Litening Pod Video**

- ***Mission Planning / Rehearsal Tool***
- ***Multiple views of target scene***
- ***Interfaces with PFPS***



# IRTSS Custom Screen



**Custom Views** [X]

**Sensor Data**

Alt(Msl):  feet

Slant Range:  mi

Type:

☐ Render Trees

**Target Data**

Lat:   ☒ N ☐ S

Lon:   ☒ W ☐ E

Type:

**TOT**

Date Time Group  
(ex. 240700APR2002)

Most Recent Valid Weather Time Range

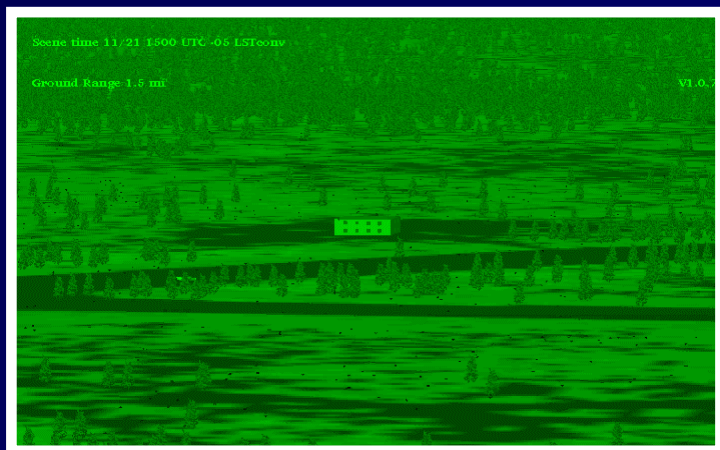
**HTML Filename**

**Reset**

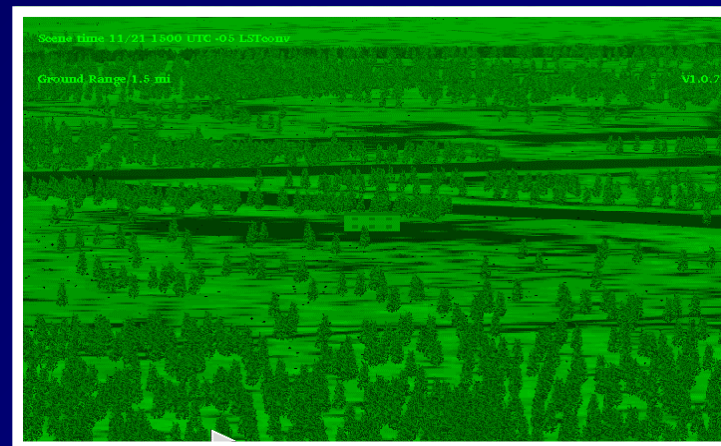
**OK** **Batch** **Cancel**



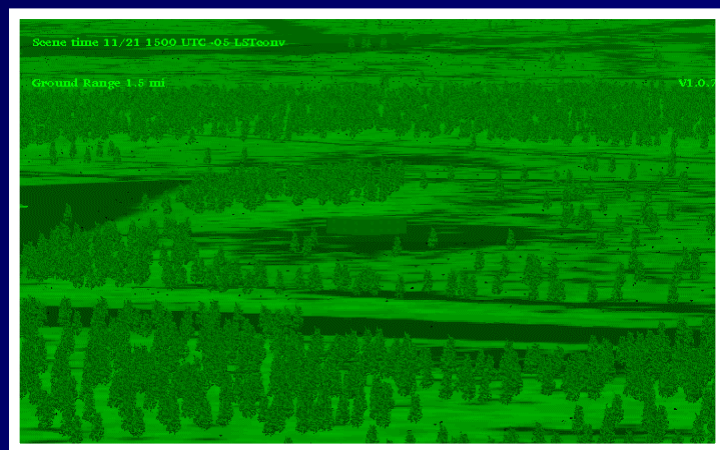
# ***IRTSS Ingress Planning***



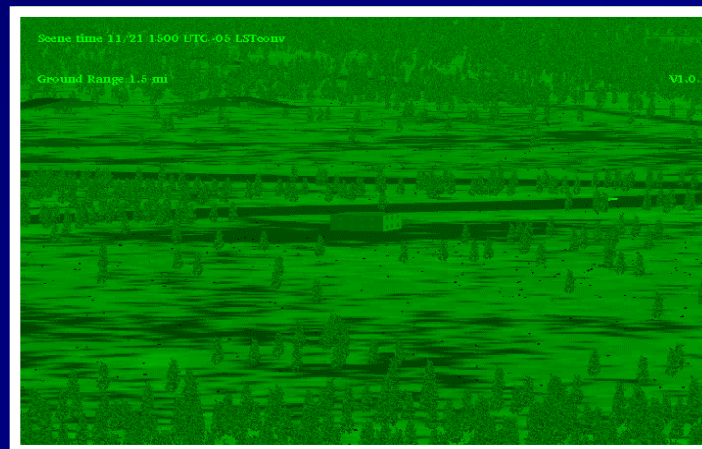
Heading 270°



Heading 0°



Heading 180°



Heading 90°





# ***IRTSS Support of OIF Mission Planning Cell***



Time Line

Operation for  
OIF  
MPC

Operation for  
OIF  
F-117

Comms with  
Qatar



**Meteorologists** →





# IRTSS Support of OIF F-117



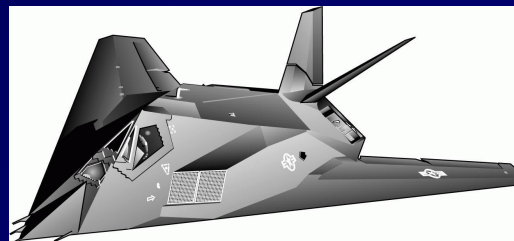
Time Line

Operation for  
OIF  
MPC

Operation for  
OIF  
F-117

Comms with  
Qatar

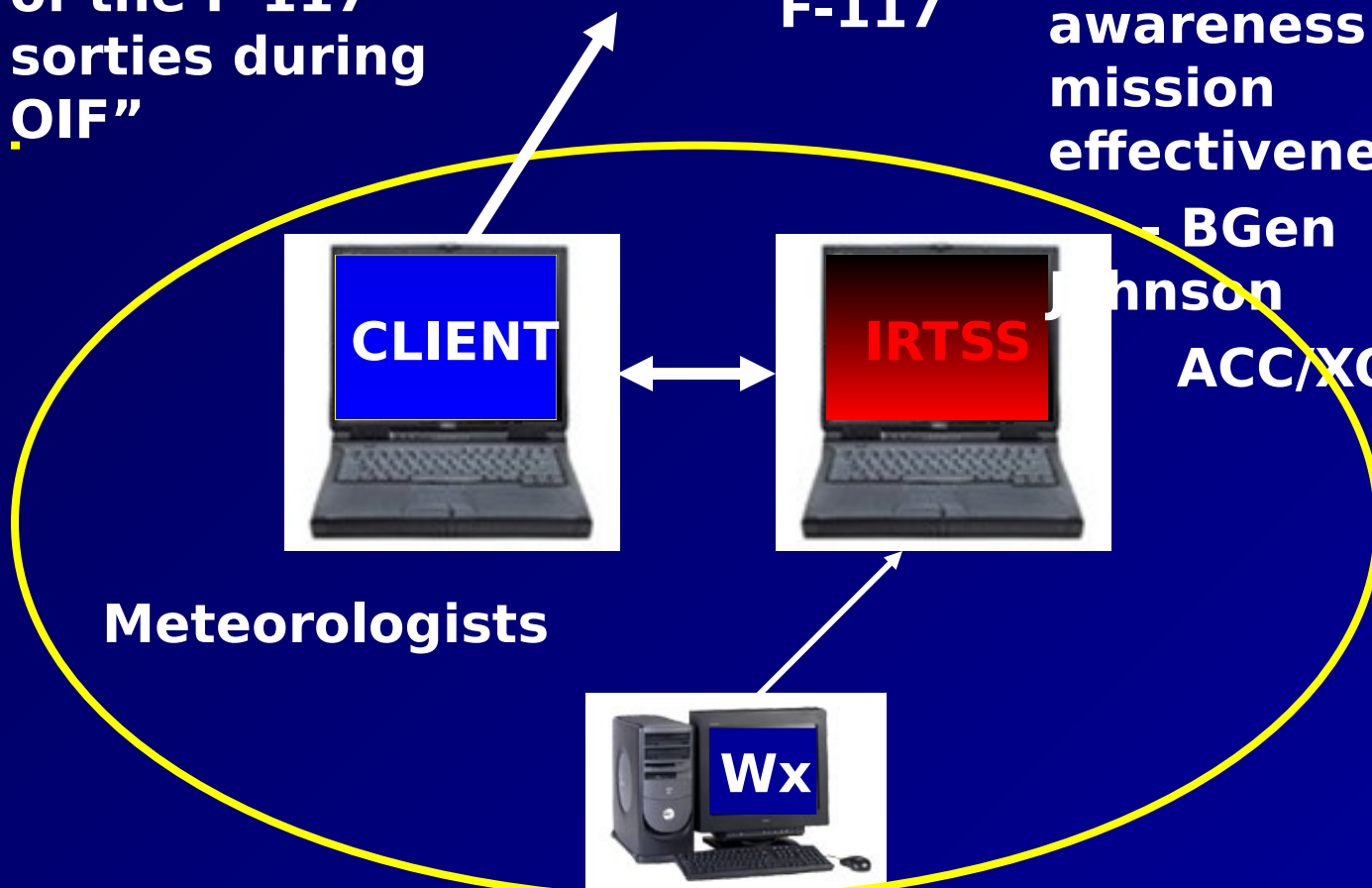
**"IRTSS  
predictions  
supported 70%  
of the F-117  
sorties during  
OIF"**



**F-117**

**"IRTSS  
increased  
[pilots']  
situational  
awareness and  
mission  
effectiveness."**

**BGen  
Johnson  
ACC/XOW**





# ***Future Plans***



- **NVG sensor/environment modeling**
- **Port IRTSS Server to Windows OS**
- **Continue development to support F-117**
- **Support operations at AF Weapons Schools**
- **Support UAV's**



# TAWS / IRTSS: Mission Planning/Execution



TOT-24 hrs

TOT-3 hrs

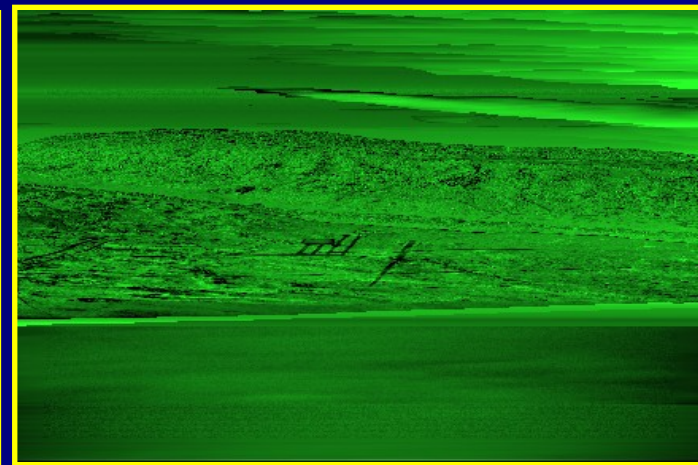
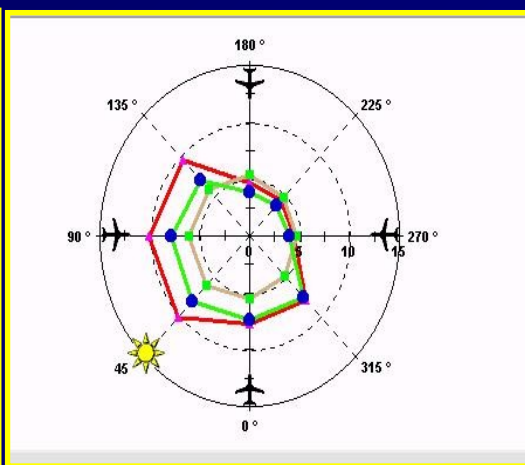
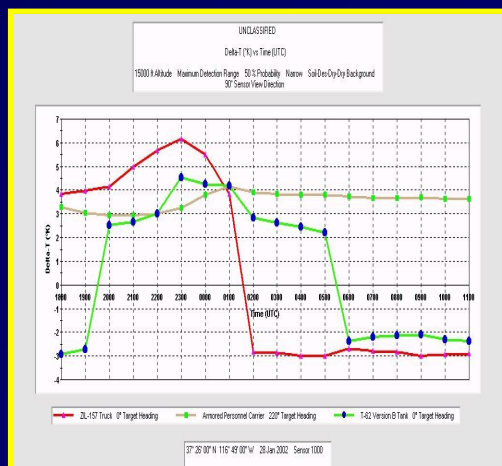
MPC

Attack plan  
(angle/altitude/time) and  
sensor selection

Pilot Brief / TST  
Sensor viewing /  
detection range  
information

**TAWS**

**IRTSS**



**“Decision-quality weather during mission planning,  
rather than showstoppers at step time”**

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# ***Contacts***

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